Attachment 7.1 – Supporting Documents

Economic Analysis – Water Supply Costs and Benefits

Madera Region – IRWM Implementation Grant Application

Table of Contents

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Attachment 7.1, Introduction

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Introduction

The proposed projects are claiming the following water supply benefits:

- Project B – Madera County, Ash Slough Arundo Eradication and Sand Removal Project – Qualitative Benefits
- Project C – Madera Irrigation District, Cottonwood, Dry and Berenda Creek Arundo Eradication and Sand Removal - Quantitative Benefits
- Project D – Root Creek Water District In-Lieu Groundwater Recharge Project - Quantitative Benefits
- Project E – Sierra National Forest Fuel Reduction Project – No Water Supply Benefits claimed

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Attachment 7.1, Project B – Ash Slough Arundo Eradication and Sand Removal

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Project B – Ash Slough Arundo Eradication and Sand Removal Project

I. Narrative of the Project's Expected Water Supply Benefits

Arundo is a fast-growing invasive bamboo which has a very high evapotranspiration rate. Though this rate has not been confirmed in any published research, initial ET studies funded by the San Joaquin Valley RC&D have shown that in the Central Valley climate *Arundo* transpires approximately three times the water used by bunch grasses (such as creeping wild rye) and 10 times the water used by clonal grasses (such as Bermuda grass). This study provides credible estimates of .12 acre feet of water use per acres per sunny day, as opposed to .01 to .05 acre feet of water use by other native vegetation. (see Attachment 7.2, page 3 Preliminary Comparison of Transpirational Water Use by *Arundo donax* and Replacement Riparian Vegetation Types in California)

This additional transpiration utilizes water which would otherwise percolate through the sandy soils of the slough channel and help to recharge the overdrafted groundwater table. Because of this, it can be confidently stated that this project will have water supply benefits.

However several factors make it difficult to document the quantitative value of this benefit (as distinguished from the Madera Irrigation District project):

- The acreage of Arundo is an estimate based on observation of several slough transects. This is compared to the Madera Irrigation District project which has aerial maps showing the actual Arundo infestation.
- Unlike the Madera Irrigation District's waterways, which are used year round for agricultural water deliveries, the Ash Slough is dry for several months of the year. This makes it more difficult to estimate yearly evapotranspiration.
- Unlike the Madera Irrigation District, which has water recorders that can measure the amount of water entering and exiting the district, the County has no means of measuring the changes in water loss within the project area.

For this reason, the Project Proponent is not claiming quantitative water supply benefits for this project. There will be definite benefits, but they can only be described in a qualitative manner.

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Attachment 7.1, Project C – Cottonwood, Dry and Berenda Creek Arundo Eradication and Sand Removal

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Project C – Cottonwood, Dry and Berenda Creek Arundo Eradication and Sand Removal

I. Narrative Description of Project's Economic Costs

The project that Madera Irrigation District (MID) is proposing will cost $2,508,114 and take approximately 4 years to complete. MID is applying for $1,789,024 in grant funding and plans on contributing $719,120 of in-kind funding. This project will eradicate Arundo and remove sediment in 32 miles of creeks in Madera County. The project costs include administration costs, permitting costs, implementation costs, oversight costs, surveys and other costs. No other costs are anticipated for this project. The project's lifespan will be until 2058.

II. Cost Details and Narrative Discussion of Table 7 and Table 11

Table 7 is based on information from the Budget described in Attachment 4.

Table 11 breaks the cost down per year for the life of the project. It is anticipated that the majority of administration and permitting costs, along with the first year of Arundo eradication, will take place in 2011. 2012 will bear the costs of the second year of Arundo eradication. 2013 will incur the costs of third year Arundo eradication. Sediment removal will occur in year 2014. From year 2015 to year 2058 it is predicted that it will take one of MID's Engineering Staff 40 hours for Administration each year ($1,680). For Maintenance, MID is planning on having to maintain the equivalent of one mile of Arundo eradication throughout the project area ($39,815). Note that these values are in 2009 dollars. The total present value of discounted project costs is **$2,542,861**.

III. Narrative of the Project's Expected Water Supply Benefits

The *Arundo* infestation and excessive sedimentation cause a number of serious water supply problems including:

- Reduce excessive evapotranspiration of water resources – *Arundo* has been found to use a great deal of water, based on comparisons with similar plants. Refer to Attachment 7.3, page 19.
- Decrease Groundwater Overdraft Effects - This area of the Central Valley is experiencing a severe groundwater overdraft. Groundwater is subsiding at a rate which reaches 5 feet per year. Arundo utilizes much more water than the native grasses. This is water that would otherwise either percolate through the sandy soils to recharge the groundwater, be used for agricultural purposes, or flow downstream to the Fresno River and San Joaquin River.
- Increase of Conveyance System Capacity. Reduced system capacity due to Arundo limits the amount of water deliveries available to MID customers. By increasing the amount of water that can be conveyed through the system groundwater pumping can be reduced, thus helping alleviate the overdraft situation.
- Effectively resolve significant water related conflicts within or between regions -

- This project will increase the amount of accessible water. Any increase in the amount of water available in the San Joaquin Valley is a large accomplishment. Water conflicts are mainly due to quantity issues. By enhancing the amount of accessible water eventually more water could be possibly available for other areas or regions.
- Addresses Statewide Priorities - The proposal addresses the Statewide Priorities of "**Drought Preparedness"** and "**Use and Reuse Water More Efficiently"** by improving agricultural irrigation efficiencies. The eradication of the Arundo will increase beneficial water supplies in the creeks, which are used to supply agricultural water. Substantial water will be saved by removing Arundo.

MID will be able to calculate a water savings based on the amount of Arundo eradicated. MID will also be able to use recorder and water delivery information where water enters and leaves the District to determine the amount of water flowing through the system compared to previous years and equate a monetary value to that. Refer to Attachment 7.3, page 3.

IV. Benefits Analysis - Table 12

Table 12 represents the physical benefits of the project. It is estimated that 300 acres of Arundo will be removed from Cottonwood, Dry, and Berenda creeks through the project. This estimate is made based on 2009 aerial data. Arundo locations were mapped in a GIS system and the area was calculated based on this mapping. Refer to Attachment 7.3, page 5.

From ET calculations, refer to Attachment 7.3, page 3, it is estimated that eradicating Arundo will save 13.6 acre feet per acre, per year. At the current 2010 MID water rate of $60 per acre foot, this equates to $814.80 of savings per year per acre. In years 2011 and 2012 savings is based on the amount of Arundo eradicated before the project is fully implemented. The total present value of water supply benefits is **$3,236,410.**

V. Benefits Analysis - Table 15

Table 15 represents the summary of Water Supply Benefits of the project. The total present value of discounted benefits is **$3,236,410.**

Table 11- Annual Cost of Project

(All costs should be in 2009 Dollars)

Project: __Project C -Madera Irrigation District-Cottonwood, Dry, and Berenda Creek Arundo Eradication and Sediment Removal_

	Initial Costs	Operations and Maintenance Costs [1]						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (f)	Discount Factor	Discounted Costs(g) x (h)
2009							$0	1.000	$0
2010							$0	0.943	$0
2011	$846,250						$846,250	0.890	$753,162
2012	$567,545						$567,545	0.840	$476,738
2013	$408,285						$408,285	0.792	$323,362
2014	$686,065						$686,065	0.747	$512,490
2015		$1,680		$39,815			$41,495	0.705	$29,254
2016		$1,680		$39,815			$41,495	0.665	$27,594
2017		$1,680		$39,815			$41,495	0.627	$26,017
2018		$1,680		$39,815			$41,495	0.592	$24,565
2019		$1,680		$39,815			$41,495	0.558	$23,154
2020		$1,680		$39,815			$41,495	0.527	$21,868
2021		$1,680		$39,815			$41,495	0.497	$20,623
2022		$1,680		$39,815			$41,495	0.469	$19,461
2023		$1,680		$39,815			$41,495	0.442	$18,341
2024		$1,680		$39,815			$41,495	0.417	$17,303
2025		$1,680		$39,815			$41,495	0.394	$16,349
2026		$1,680		$39,815			$41,495	0.371	$15,395
2027		$1,680		$39,815			$41,495	0.350	$14,523
2028		$1,680		$39,815			$41,495	0.331	$13,735
2029		$1,680		$39,815			$41,495	0.312	$12,946
2030		$1,680		$39,815			$41,495	0.294	$12,200
2031		$1,680		$39,815			$41,495	0.278	$11,536
2032		$1,680		$39,815			$41,495	0.262	$10,872
2033		$1,680		$39,815			$41,495	0.247	$10,249
2034		$1,680		$39,815			$41,495	0.233	$9,668
2035		$1,680		$39,815			$41,495	0.220	$9,129
2036		$1,680		$39,815			$41,495	0.207	$8,589
2037		$1,680		$39,815			$41,495	0.196	$8,133
2038		$1,680		$39,815			$41,495	0.185	$7,677
2039		$1,680		$39,815			$41,495	0.174	$7,220
2040		$1,680		$39,815			$41,495	0.164	$6,805
2041		$1,680		$39,815			$41,495	0.155	$6,432
2042		$1,680		$39,815			$41,495	0.146	$6,058
2043		$1,680		$39,815			$41,495	0.138	$5,726
2044		$1,680		$39,815			$41,495	0.130	$5,394
2045		$1,680		$39,815			$41,495	0.123	$5,104
2046		$1,680		$39,815			$41,495	0.116	$4,813
2047		$1,680		$39,815			$41,495	0.109	$4,523
2048		$1,680		$39,815			$41,495	0.103	$4,274
2049		$1,680		$39,815			$41,495	0.097	$4,025
2050		$1,680		$39,815			$41,495	0.092	$3,818
2051		$1,680		$39,815			$41,495	0.087	$3,610
2052		$1,680		$39,815			$41,495	0.082	$3,403
2053		$1,680		$39,815			$41,495	0.077	$3,195
2054		$1,680		$39,815			$41,495	0.073	$3,029
2055		$1,680		$39,815			$41,495	0.069	$2,863
2056		$1,680		$39,815			$41,495	0.065	$2,697
2057		$1,680		$39,815			$41,495	0.061	$2,531
2058		$1,680		$39,815			$41,495	0.058	$2,407
Project Life								...	
							Total Present Value of Discounted Costs (Sum of Column (i))		$2,542,861
							Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries		

Comments: This project's lifespan is until 2058. Administration costs are estimated at one MID Engineering Department employee working on the project for 40 hours per year at a rate of $42 per hour. The Maintenance cost of $39,815 is the cost to eradicate Arundo from one mile of stream, which is the estimated amount might occur for maintenance purposes.

(1) The incremental change in O&M costs attributable to the project.

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Table 12 - Annual Water Supply Benefits

(All benefits should be in 2009 dollars)

Project: Project C - Madera Irrigation District-Cottonwood, Dry, and Berenda Creek Arundo Eradication and Sediment Removal

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2009	a				0		$0	1.000	$0
2010	a				0		$0	0.943	$0
2011	a	Acres of Arundo Removed	0	123	123	$815	$100,220	0.890	$89,196
2012	a	Acres of Arundo Removed	0	194	194	$815	$158,071	0.840	$132,780
2013	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.792	$193,596
2014	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.747	$182,597
2015	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.705	$0
2016	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.665	$162,553
2017	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.627	$153,264
2018	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.592	$144,708
2019	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.558	$136,398
2020	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.527	$128,820
2021	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.497	$121,487
2022	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.469	$114,642
2023	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.442	$108,042
2024	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.417	$101,931
2025	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.394	$96,309
2026	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.371	$90,687
2027	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.350	$85,554
2028	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.331	$80,910
2029	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.312	$76,265
2030	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.294	$71,865
2031	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.278	$67,954
2032	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.262	$64,043
2033	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.247	$60,377
2034	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.233	$56,955
2035	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.220	$53,777
2036	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.207	$50,599
2037	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.196	$47,910
2038	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.185	$45,221

Table 12 - Annual Water Supply Benefits

(All benefits should be in 2009 dollars)

Project: Project C - Madera Irrigation District-Cottonwood, Dry, and Berenda Creek Arundo Eradication and Sediment Removal

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value [1]	(h) Annual $ Value (f) x (g) [1]	(i) Discount Factor [1]	(j) Discounted Benefits (h) x (i) [1]
2039	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.174	$42,533
2040	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.164	$40,088
2041	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.155	$37,888
2042	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.146	$35,688
2043	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.138	$33,733
2044	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.130	$31,777
2045	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.123	$30,066
2046	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.116	$28,355
2047	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.109	$26,644
2048	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.103	$25,177
2049	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.097	$23,711
2050	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.092	$22,488
2051	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.087	$21,266
2052	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.082	$20,044
2053	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.077	$18,822
2054	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.073	$17,844
2055	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.069	$16,866
2056	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.065	$15,889
2057	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.061	$14,911
2058	a	Acres of Arundo Removed	0	300	300	$815	$244,440	0.058	$14,178
Project Life								…	
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	**$3,236,410**

Comments: Refer to attached ET Table for Value information. This projects lifespan is until 2058.

[1] *Complete these columns if dollar value is being claimed for the benefit.*

Table 15. Total Water Supply Benefits

(All benefits should be in 2009 dollars)

Project: Project C - Madera Irrigation District-Cottonwood, Dry, and Berenda Creek Arundo Eradication and Sediment Removal

Total Discounted Water Supply Benefits (a)	Total Discounted Avoided Project Costs (b)	Other Discounted Water Supply Benefits (c)	Total Present Value of Discounted Benefits (d) (a) + (c) or (b) + (c)
$3,236,410	$0	$0	**$3,236,410**

Comments:

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Attachment 7.1, Project D – Root Creek In-Lieu Groundwater Recharge

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Project D – Root Creek Water District In-Lieu Groundwater Recharge Project

Project Overview

The Root Creek Water District In-Lieu Groundwater Recharge Project includes the acquisition of new surface water supplies and construction of a new 48-inch diameter pipeline that would deliver surface water to 3,200 acres of lands that currently rely exclusively on groundwater.

Using available surface water supplies, the proposed pipeline will be able to deliver, on average, 6,100 AF/year to the project area. In some years the pipeline would be able to provide all of the water demands in the project area, or about 9,400 AF/year. The pipeline will have capacity to convey about 50 cfs, or about 36,000 AF/year if operated continuously. Therefore, the project yield could eventually be increased if the project area is expanded or the pipeline is connected to recharge facilities.

The water sources would include San Joaquin River Section 215 floodwater, CVP water supplies purchased from Madera Irrigation District, and a firm water supply purchased from the Westside Mutual Water Company.

The project would import a new surface water supply into Madera County. Every acre-foot of surface water delivered by the project will offset an acre-foot of groundwater pumping and reduce overdraft in the local area and surrounding communities. The project will help to reverse the net overdraft in Southeastern Madera County of 22,000 AF/year, as referenced in a report by Kenneth D. Schmidt Associates entitled '*Hydrogeologic Investigation – Southeastern Madera County*', prepared in 1998 and updated in 2001. The estimated overdraft within RCWD is 3,400 AF, which is referenced in the same study. The project yield of 6,100 AF will not only mitigate for this local overdraft, but also deliver a net positive balance of (6,100-3,400) = 2,700 AF/year within RCWD. The surface water delivery will also help to improve local water quality and improve water reliability.

Water Supplies

The proposed project will use water from three sources: San Joaquin floodwater (Section 215 water), Class II CVP water purchased from Madera Irrigation District, and water purchased under contract from the Westside Mutual Water Company. Agreements for these water supplies are discussed in Attachment 7.4, page 3.

The cost of the water supplies is presented in **Table 1** below:

Table 1 – Water Purchase Costs (Cost/AF)

Description	Section 215 Water	Class II Water	Westside Mutual Water*
Purchase Cost	$13.29	$29.51	$55.00
Conveyance Charge	$20.81	-	$20.81
Overhead Charge	-	$50.00	-
Total	$34.10	$79.51	$75.81

*By agreement (Attachment 3.4 page 3), the cost to purchase Westside Mutual water is equivalent to the cost to pump groundwater in RCWD. Groundwater pumping calculations are shown in Attachment 3.4, page 83.

The annual average volumes of each water supply are listed below:

Section 215 Floodwater – 2,100/AF
Class II Water – 2,300/AF
Westside Mutual Water - 1,700 AF

The Section 215 floodwater and Class II water quantities are based on a hydrologic simulation, shown on Attachment 7.4, page 87. This simulation was prepared for the project feasibility study. Westside Mutual water will be used to supplement the other two supplies, as needed, to provide 6,100 AF/year. The net average cost of these three water supplies will be $62.85/AF (rounded to $63/AF).

With and Without Project

With the project an average of 6,100 AF of new surface water supplies will be imported into the area. This water supply will supplant groundwater pumping and help to reduce groundwater overdraft. The water supply will also help to improve the overall water reliability in the region, and help to improve the water quality (see Attachments 8.1 and 8.4). Without the project no new water supplies will be imported, groundwater will be used to meet water demands, and the groundwater level will continue to decline at more than 3 feet per year in the area.

Quantification of Benefits

The project benefits can be measured and quantified in three ways including: 1) The quantity of surface water purchased from MID, USBR and Westside Mutual; 2) The quantity of water diverted into RCWD from Lateral 6.2; and 3) The quantity of water sold to landowners in the project area. These three quantities should be very similar, and vary only by the amount of conveyance losses.

The benefits will be received throughout the life of the project, which is 50 years. The facilities will be able to operate for that period and the water supply agreements all extend for 50 years through contract renewal clauses.

Area Benefitted

The area benefitted will primarily include the 3,200 acres that will receive the new surface water supply. The surrounding area will also benefit from reduced stress on the groundwater resources.

Certainty of Analysis

There is a high certainty that these benefits will be realized for the following reasons:

- The feasibility of the project was confirmed in a DWR funded feasibility study in 2003, and the main pipeline design is now 95% complete.
- Permitting for the project is largely complete. A CEQA Negative Declaration was filed on November 17, 2010 and no comments were received from the public.
- Biological and Cultural Resources surveys for the project are complete and have been accepted by the USBR.
- Root Creek Water District has secured two water supplies for the project (Class II water from MID and Westside Mutual water) and expects to secure the third water supply (Section 215 floodwater) within a few months. These agreements are discussed in more detail in Attachment 7.4, page 3.
- The local growers have a demand for the water and are interested in using the cleaner surface water supply.

Benefit Calculations

Water supply benefits are shown in Tables 11 and 13 at the end of this section**.** The annual water supply benefit is 6,100 AF/year. The primary assumptions used in the analysis are provided below:

1. The average cost to purchase water for the project is $62.85/AF (see section entitled 'Water Supplies' above).

2. Operations costs for the proposed project include water purchase costs of $62.85 x 6,100 AF/year.

3. Estimated maintenance and administration costs for the project are each $12,000/year. These values were taken from a previous analysis from 2003. The 2003 estimates were reviewed and confirmed, and then adjusted for inflation using Table 10 in the Proposal Solicitation Package.

4. The avoided cost is the cost to construct a groundwater bank. Groundwater banks are common in the area and would be able to provide the same water supply benefits. A groundwater bank would include recharge facilities and use existing farmer-owned wells to retrieve the water. Attachment 7.4, page 91 includes cost information on five groundwater banks recently constructed in the area. These groundwater banks were constructed by local irrigation districts and are representative of local construction costs. Attachment 7.4, page 95 is a graph showing the unit cost of groundwater bank capacity versus the size of the groundwater bank. The graph clearly shows a trend in unit cost of storage capacity versus the size of the bank. Using this graph, the cost of a groundwater bank that can recharge 6,100 AF/year is $375/AF of storage capacity. This equates to a capital cost of $2,287,500.

5. Groundwater pumping is not considered a suitable alternative or avoided cost because the groundwater level is rapidly declining, and it is not a sustainable water supply. In addition, it is not a fair comparison since groundwater pumping contributes to groundwater overdraft, whereas the importation of surface water does not.

6. The Proposed Project and Avoided Cost Project are assumed to use the same water supplies. The water supplies secured for the project are very affordable at $63/AF. In comparison, spot market water purchases in the area have ranged from $100 to $530/AF over the past eight years. The economic analysis did not use these higher spot market prices as an avoided water purchase cost. As a result, the economic analysis is conservative and likely underestimates the benefit-cost ratio.

7. Operations and Maintenance costs for the Avoided Project are based on the following:
    - Water purchase costs are $62.85/AF x 6,100 AF/year
    - Groundwater pumping costs are $55/AF x 6,100 AF/year
    - Administration costs are $12,000/year (same as the proposed project)
    - Maintenance costs are 1% of the capital costs each year ($22,875/year)
    - Total O&M costs are $753,760/year

Table 11- Annual Cost of Project

(All costs should be in 2009 Dollars)

Project: Project D - Root Creek Water District In-Lieu Groundwater Recharge Project

	Initial Costs	Operations and Maintenance Costs [1]						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (f)	Discount Factor	Discounted Costs(g) x (h)
2009							$0	1.000	$0
2010							$0	0.943	$0
2011	$250,000						$250,000	0.890	$222,500
2012	$5,250,000	$12,000	$383,385	$12,000	$0	$0	$5,657,385	0.840	$4,752,203
2013		$12,000	$383,385	$12,000	$0	$0	$407,385	0.792	$322,649
2014		$12,000	$383,385	$12,000	$0	$0	$407,385	0.747	$304,317
2015		$12,000	$383,385	$12,000	$0	$0	$407,385	0.705	$287,206
2016		$12,000	$383,385	$12,000	$0	$0	$407,385	0.665	$270,911
2017		$12,000	$383,385	$12,000	$0	$0	$407,385	0.627	$255,430
2018		$12,000	$383,385	$12,000	$0	$0	$407,385	0.592	$241,172
2019		$12,000	$383,385	$12,000	$0	$0	$407,385	0.558	$227,321
2020		$12,000	$383,385	$12,000	$0	$0	$407,385	0.527	$214,692
2021		$12,000	$383,385	$12,000	$0	$0	$407,385	0.497	$202,470
2022		$12,000	$383,385	$12,000	$0	$0	$407,385	0.469	$191,064
2023		$12,000	$383,385	$12,000	$0	$0	$407,385	0.442	$180,064
2024		$12,000	$383,385	$12,000	$0	$0	$407,385	0.417	$169,880
2025		$12,000	$383,385	$12,000	$0	$0	$407,385	0.394	$160,510
2026		$12,000	$383,385	$12,000	$0	$0	$407,385	0.371	$151,140
2027		$12,000	$383,385	$12,000	$0	$0	$407,385	0.350	$142,585
2028		$12,000	$383,385	$12,000	$0	$0	$407,385	0.331	$134,844
2029		$12,000	$383,385	$12,000	$0	$0	$407,385	0.312	$127,104
2030		$12,000	$383,385	$12,000	$0	$0	$407,385	0.294	$119,771
2031		$12,000	$383,385	$12,000	$0	$0	$407,385	0.278	$113,253
2032		$12,000	$383,385	$12,000	$0	$0	$407,385	0.262	$106,735
2033		$12,000	$383,385	$12,000	$0	$0	$407,385	0.247	$100,624
2034		$12,000	$383,385	$12,000	$0	$0	$407,385	0.233	$94,921
2035		$12,000	$383,385	$12,000	$0	$0	$407,385	0.220	$89,625
2036		$12,000	$383,385	$12,000	$0	$0	$407,385	0.207	$84,329
2037		$12,000	$383,385	$12,000	$0	$0	$407,385	0.196	$79,847
2038		$12,000	$383,385	$12,000	$0	$0	$407,385	0.185	$75,366
2039		$12,000	$383,385	$12,000	$0	$0	$407,385	0.174	$70,885
2040		$12,000	$383,385	$12,000	$0	$0	$407,385	0.164	$66,811
2041		$12,000	$383,385	$12,000	$0	$0	$407,385	0.155	$63,145
2042		$12,000	$383,385	$12,000	$0	$0	$407,385	0.146	$59,478
2043		$12,000	$383,385	$12,000	$0	$0	$407,385	0.138	$56,219
2044		$12,000	$383,385	$12,000	$0	$0	$407,385	0.130	$52,960
2045		$12,000	$383,385	$12,000	$0	$0	$407,385	0.123	$50,108
2046		$12,000	$383,385	$12,000	$0	$0	$407,385	0.116	$47,257
2047		$12,000	$383,385	$12,000	$0	$0	$407,385	0.109	$44,405
2048		$12,000	$383,385	$12,000	$0	$0	$407,385	0.103	$41,961
2049		$12,000	$383,385	$12,000	$0	$0	$407,385	0.097	$39,516
2050		$12,000	$383,385	$12,000	$0	$0	$407,385	0.092	$37,479
2051		$12,000	$383,385	$12,000	$0	$0	$407,385	0.087	$35,442
2052		$12,000	$383,385	$12,000	$0	$0	$407,385	0.082	$33,406
2053		$12,000	$383,385	$12,000	$0	$0	$407,385	0.077	$31,369
2054		$12,000	$383,385	$12,000	$0	$0	$407,385	0.073	$29,739
2055		$12,000	$383,385	$12,000	$0	$0	$407,385	0.069	$28,110
2056		$12,000	$383,385	$12,000	$0	$0	$407,385	0.065	$26,480
2057		$12,000	$383,385	$12,000	$0	$0	$407,385	0.061	$24,850
2058		$12,000	$383,385	$12,000	$0	$0	$407,385	0.058	$23,628
2059		$12,000	$383,385	$12,000	$0	$0	$407,385	0.055	$22,406
2060		$12,000	$383,385	$12,000	$0	$0	$407,385	0.052	$21,184
2061		$12,000	$383,385	$12,000	$0	$0	$407,385	0.049	$19,962
2062		$12,000	$383,385	$12,000	$0	$0	$407,385	0.046	$18,740
							Total Present Value of Discounted Costs (Sum of Column (i))		$10,368,073
							Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries		

Comments:

(1) The incremental change in O&M costs attributable to the project.

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Table 13 - Annual Costs of Avoided Projects

(All avoided costs should be in 2009 dollars)

Project: Project D - Root Creek Water District In-Lieu Groundwater Recharge Project

	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
YEAR	Alternative (Avoided Project Name): Open Market Water Purchases *Avoided Project Description: Distribution pipeline using water purchased on the open market* Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)	Discount Factor	Discounted Costs (e) x (f)
2011	$0				1.000	$0
2012	$2,287,500		$753,760	$3,041,260	0.943	$2,867,908
2013			$753,760	$753,760	0.899	$677,630
2014			$753,760	$753,760	0.839	$632,405
2015			$753,760	$753,760	0.791	$596,224
2016			$753,760	$753,760	0.746	$562,305
2017			$753,760	$753,760	0.705	$531,401
2018			$753,760	$753,760	0.665	$501,250
2019			$753,760	$753,760	0.627	$472,608
2020			$753,760	$753,760	0.592	$446,226
2021			$753,760	$753,760	0.558	$420,598
2022			$753,760	$753,760	0.527	$397,232
2023			$753,760	$753,760	0.497	$374,619
2024			$753,760	$753,760	0.469	$353,513
2025			$753,760	$753,760	0.442	$333,162
2026			$753,760	$753,760	0.417	$314,318
2027			$753,760	$753,760	0.394	$296,981
2028			$753,760	$753,760	0.371	$279,645
2029			$753,760	$753,760	0.350	$263,816
2030			$753,760	$753,760	0.331	$249,495
2031			$753,760	$753,760	0.312	$235,173
2032			$753,760	$753,760	0.294	$221,605
2033			$753,760	$753,760	0.278	$209,545
2034			$753,760	$753,760	0.262	$197,485
2035			$753,760	$753,760	0.247	$186,179
2036			$753,760	$753,760	0.233	$175,626
2037			$753,760	$753,760	0.220	$165,827
2038			$753,760	$753,760	0.207	$156,028
2039			$753,760	$753,760	0.196	$147,737
2040			$753,760	$753,760	0.185	$139,446
2041			$753,760	$753,760	0.174	$131,154
2042			$753,760	$753,760	0.164	$123,617
2043			$753,760	$753,760	0.155	$116,833
2044			$753,760	$753,760	0.146	$110,049
2045			$753,760	$753,760	0.138	$104,019
2046			$753,760	$753,760	0.130	$97,989
2047			$753,760	$753,760	0.123	$92,712
2048			$753,760	$753,760	0.116	$87,436
2049			$753,760	$753,760	0.109	$82,160
2050			$753,760	$753,760	0.103	$77,637
2051			$753,760	$753,760	0.097	$73,115
2052			$753,760	$753,760	0.092	$69,346
2053			$753,760	$753,760	0.087	$65,577
2054			$753,760	$753,760	0.082	$61,808
2055			$753,760	$753,760	0.077	$58,040
2056			$753,760	$753,760	0.073	$55,024
2057			$753,760	$753,760	0.069	$52,009
2058			$753,760	$753,760	0.065	$48,994
2059			$753,760	$753,760	0.061	$45,979
2060			$753,760	$753,760	0.058	$43,718
2061			$753,760	$753,760	0.055	$41,457
2062			$753,760	$753,760	0.052	$39,196
Project Life				0	…	
					Total Present Value of Discounted Costs (Sum of Column (g))	$14,083,857
					(%) Avoided Cost Claimed by Project	
					Total Present Value of Discounted Avoided Project Costs Claimed by alternative Project (Total Present Value of Discounted Costs x % Avoided Cost Claimed by Project)	
Comments:						

Avoided O&M Costs include: 1) $62.85/AF x 6,100 AF for water purchases, 2) $55/AF x 6,100 AF for groundwater pumping to retrieve the water, 3) $12,000/year for administration, and 4) $22,875/year (1% of capital costs) for maintenance.

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Table 15. Total Water Supply Benefits

(All benefits should be in 2009 dollars)

Project: Project D - Root Creek Water District In-Lieu Groundwater Recharge Project

Total Discounted Water Supply Benefits (a)	Total Discounted Avoided Project Costs (b)	Other Discounted Water Supply Benefits (c)	Total Present Value of Discounted Benefits (d) (a) + (c) or (b) + (c)
$0	$14,083,857	$0	**$14,083,857**

Comments:

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Attachment 7.1, Project E – Sierra National Forest Fuels Reduction Project

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Project E – Sierra National Forest Fuels Reduction Project

Forest Service vegetation management projects are expected to have minimal direct impact on water yield. In addition to fuel reduction, another goal of these projects is to restore ecological function and move the landscape toward old growth characteristics. Treatments remove water-competing vegetation allowing residual vegetation to respond with increased vigor. In the long term, these healthier ecosystems maintain a balanced hydrologic regime in which infiltration, evapotranspiration, and runoff provide for the magnitude and timing of stream flows that are beneficial for aquatic ecosystems and downstream water users. However the Project Proponent is not claiming quantitative or qualitatively measurable impacts on water supply.

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